Docket No.: LU05004USU (Akkerman 1-51)
Serial No.: 10/701,183

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Akkerman et al.
DOCKET NO.: LU05004USU
SERIAL NO.: 10/701,183
GROUP ART UNIT: 2813
DATE FILED: November 4, 2003
EXAMINER: Nguyen, Thanh T.
CONFIRMATION NO.: 5025

TITLE: DEVICES HAVING LARGE ORGANIC SEMICONDUCTOR CRYSTALS AND METHODS OF MAKING THE SAME

I hereby certify that this correspondence (along with any paper referred to as being attached or enclosed) is being facsimile transmitted to the United States Patent and Trademark Office, Fax No. 571-273-8300 on July 29, 2007.

Jay M. Brown

July 29, 2007

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF ON APPEAL TRANSMITTAL

Sir:

Transmitted herewith is a Brief on Appeal for this application.

STATUS

Applicant is other than a small entity.

EXTENSION OF TIME

The proceedings herein are for a patent application and the provisions of 37 CFR § 1.136 apply. A Notice of Appeal was filed by facsimile in this application on May 22, 2007. A

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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPELLANTS:	Akkerman et al.	EXAMINER:	Thanh T. Nguyen
SERIAL NO.:	10/701,183	ART UNIT:	2813
FILED:	November 4, 2003	CASE NO.:	LU05004USU (Akkerman 1-51)

CONFIRMATION NO.: 5025
ENTITLED: DEVICES HAVING LARGE ORGANIC SEMICONDUCTOR CRYSTALS AND METHODS OF MAKING THE SAME

THE ECLIPSE GROUP LLP
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July 29, 2007

Certificate of Transmission

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Jay M. Brown

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANTS' BRIEF ON APPEAL

A Notice of Appeal was filed by facsimile in this patent application on May 22, 2007. A petition and fee for a one-month extension of the two-month shortened statutory filing deadline for this Brief on Appeal to August 22, 2007 is enclosed.

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petition and $120 fee for a one month extension of the two month shortened statutory filing deadline for this Brief on Appeal to August 22, 2007 is enclosed. If any further extension is required, then this is a conditional petition for that further extension.

APPELLANT'S BRIEF

Transmitted herewith is Appellant's Brief on Appeal.

Pursuant to 37 CFR 41.20(b)(2) a filing fee of $500 is required.

FEE DEFICIENCY

If there is any fee deficiency, or if any additional fees are required, please charge Deposit Account No. 50-2542.

Respectfully submitted,

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PAGE 4/45 * RCVD AT 7/29/2007 12:43:18 AM [Eastern Daylight Time] * SVR:USPTO-EFXRF-2/10 * DNIS:2738300 * CSID:9193136170 * DURATION (mm-ss):18-32

Table of Contents

1. Real Party in Interest

The real party in interest is the assignee, Lucent Technologies Inc.

2. Related Appeals and Interferences

There are no prior or pending appeals, interferences or judicial proceedings known to appellant, the appellant's legal representative, or assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. Status of Claims

Claims 1-3, 5-8, 10-13, 19, 21-24, 26, and 28-30 are pending. Claims 4, 9, 14-18, 20, 25 and 27 have been canceled. This is an appeal regarding all of the pending claims 1-3, 5-8, 10-13, 19, 21-24, 26, and 28-30.

4. Status of Amendments

No amendments have been filed since the Final Official Action was mailed on March 1, 2007.

5. Summary of Claimed Subject Matter

A semiconductor apparatus 100, 200 is provided as shown in FIGS. 1-2, discussed in the specification at pages 6-11, and recited in independent claim 1, that includes a dielectric layer 130, 230 comprising a surface, a portion of the surface having exposed aromatic groups, the dielectric layer 130, 230 being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols;

and a polycrystalline semiconductor layer 140, 260 including an organic semiconductor composition overlying and in contact with the portion of the surface, the organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

An integrated circuit is provided as discussed in the specification at pages 6-11 and recited in independent claim 19, including a semiconductor apparatus 100, 200 as shown in FIGS. 1-2 comprising: a dielectric layer 130, 230 comprising a surface, a portion of the surface having exposed aromatic groups, the dielectric layer 130, 230 being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols; a polycrystalline semiconductor layer 140, 260 comprising an organic semiconductor composition overlying and in contact with the portion of the surface, the organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety; a gate electrode 120, 220; a source electrode 150, 240; and a drain electrode 160, 250; the source and drain electrodes 150, 160, 240, 250 being in spaced apart conductive contact with a channel portion of the semiconductor layer 140, 260, the gate electrode 120, 220 being positioned to control a conductivity of the channel portion.

A semiconductor apparatus 100, 200 is provided as shown in FIGS. 1-2, discussed in the specification at pages 6-11, and recited in claim 28, comprising: a dielectric layer 130, 230 comprising a surface, a portion of the surface having exposed aromatic groups, the dielectric layer 130, 230 including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate); and a polycrystalline semiconductor layer

140, 260 comprising an organic semiconductor composition overlying and in contact with the portion of the surface, the organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

6. Grounds of Rejection to be Reviewed on Appeal

Whether claims 1-3, 7-8, 10-11, 13, 19 and 22-24 are patentable under 35 U.S.C. §102(b) over Katz U.S. Patent No. 6,403,397 ("Katz").

Whether claims 5-6, 12-13, 21 and 28-30 are patentable under 35 U.S.C. §103(a) over Katz in view of Klauk, H. et al., "High-Mobility Polymer Gate Dielectric Pentacene Thin Film Transistors", Journal of Applied Physics, Vol. 92, No. 9, pp. 5259-5263 (Nov. 1, 2002) ("Klauk"); and further in view of Mushrush, M. et al., "Easily Processable Phenylene-Thiophene-Based Organic Field-Effect Transistors and Solution-Fabricated Nonvolatile Transistor Memory Elements", Journal American Chemical Society, Vol. 125, No. 31, pp. 9414-9423 (2003) ("Mushrush").

Whether claim 26 is patentable under 35 U.S.C. §103(a) over Katz in view of Katz et al., "Synthesis, Solubility, and Field-Effect Mobility of Elongated and Oxa-Substituted αω-Dialkyl Thiophene Oligomers. Extension of "Polar Intermediate" Synthetic Strategy and Solution Deposition on Transistor Substrates", Chem. Mater. Vol. 10, pp. 633-638 (American Chemical Society 1998) ("Katz Article").

7. Argument

Each of Katz and Mushrush fails to disclose and fails to suggest, in any parts pointed to by the Official Action, a semiconductor device including a dielectric layer surface having exposed aromatic groups as recited in Appellants' claims. Each of Katz and Mushrush fails to disclose or suggest, in any parts pointed to by the Official Action, the selection of an aromatic composition for a dielectric layer. Each of Katz and Mushrush fails to disclose and fails to suggest, in any part pointed to by the Official Action, a device having a dielectric layer either (A) including "a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate)" or (B) "formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols". Klauk discloses a pentacene organic semiconductor thin film transistor including poly-4-vinylphenol-co-2-hydroxyethylmethacrylate as a gate dielectric layer. Appellants' claims recite semiconductors "comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety". Pentacene, used as the semiconductor by Klauk, does not have such alkyl chains. As Klauk instructs and as confirmed by Appellants' specification, the electrical performance of thin film transistors is often measured in terms of carrier field-effect mobility. The Official Action has not pointed to any statements in Klauk that would lead one of ordinary skill in the art to believe that a device having improved mobility could be made by substituting Klauk's PVP copolymer in Katz's devices.

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**REJECTION OF CLAIMS 1-3, 7-8, 10-11, 13, 19 AND 22-24
UNDER 35 U.S.C. §102(B) AS ASSERTEDLY ANTICIPATED BY KATZ**

Independent claims 1 and 19, and claims 2, 3, 7-8, 10, 11, 13, and 22-24 all depending directly or indirectly from claim 1, were rejected under 35 U.S.C. §102(b) as assertedly anticipated by Katz.

The Composition Ingredients Are Structural Claim Limitations of Claims 1 and 19

Each of independent claims 1 and 19 recite in part:

> a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups.

Each of independent claims 1 and 19 recite in part:

> a polycrystalline semiconductor layer comprising an organic semiconductor composition overlying and in contact with said portion of said surface, said organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

The recitations of "...a dielectric layer comprising a surface...having exposed aromatic groups..." define the chemical composition of the surface. They are structural limitations of claims 1 and 19. Likewise, the recitations of "...a polycrystalline semiconductor layer comprising an organic semiconductor composition...comprising alkyl chains..." define the chemical composition of the semiconductor layer. They, too, are structural limitations of claims 1 and 19.

The Precursor Compositions for the Dielectric Layer Are

Structural Limitations of Claims 1 and 19

Each of independent claims 1 and 19 recite in part:

> dielectric layer being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols.

These recitations constitute structural limitations of claims 1 and 19 for two reasons: (1) these recitations expressly define a dielectric layer having exposed aromatic groups selected from naphthalenes, styrenes, phenols, benzenes, and cresols; and (2) these recitations imply the specific chemical structures of aromatic polymers forming the dielectric layer, when aromatic precursors are utilized, selected from naphthalenes, styrenes, phenols, benzenes, and cresols.

(1) These recitations expressly define a dielectric layer having exposed aromatic groups selected from naphthalenes, styrenes, phenols, benzenes, and cresols. These recitations expressly define the chemical compositions of precursors utilized in forming the dielectric layer 130, 230 of the apparatus 100, 200. The recited precursors include aromatic moieties for polymerization to form the "dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups". Claims 1 and 19 hence expressly recite a dielectric layer having exposed aromatic groups formed from one or more aromatic naphthalene, styrene, phenol, benzene, and cresol precursors. Claims 1 and 19 expressly define, as a structural limitation, a dielectric layer having exposed polymeric aromatic groups selected from naphthalenes, styrenes, phenols, benzenes, and cresols.

(2) Appellants acknowledge the Official Action's argument that the recitations in claims 1 and 19 of precursors for forming the dielectric layer can be construed as being "process" limitations. However, these recitations also are "product" limitations as discussed in (1) above insofar as claims 1 and 19 directly link the aromatic structures of the precursors and the structures of the exposed aromatic groups of the dielectric layer. Furthermore, even granting a "process" interpretation for these claim recitations, the specific polymer structures "formed from a precursor composition" of the dielectric layer 130, 230 "having exposed aromatic groups" are implied by the recitations in claims 1 and 19 of the chemical compositions of the precursors, "naphthalenes, styrenes, phenols, benzenes, and cresols".

One of ordinary skill in the art of polymer science knows and readily understands the polymer structures that are obtained when aromatic precursors selected from "naphthalenes, styrenes, phenols, benzenes, and cresols" are polymerized. Even under such a "process step" interpretation, the recitations in clams 1 and 19 of aromatic precursors selected from "naphthalenes, styrenes, phenols, benzenes, and cresols" would be expected to impart distinctive structural characteristics to the apparatus 100, 200. In particular, such recitations can be expected to result in inclusion of the aromatic structures of the precursors in the structure of the dielectric layers. These recitations therefore are capable of construction as structural limitations of claims 1 and 19.

The Manual of Patent Examining Procedure ("MPEP") section 2113, states in part (emphasis supplied):

> The <u>structure implied</u> by the process steps <u>should be considered</u> when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is

made, or <u>where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product</u>. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding "interbonded by interfusion" to <u>limit structure of the claimed composite</u> and noting that terms such as "welded," "intermixed," "ground in place," "press fitted," and "etched" are <u>capable of construction as structural limitations</u>.)

<u>The Teachings of Katz</u>

FIG. 1 of Katz schematically shows a semiconductor device having top contact geometry. Formation of the semiconductor device generally involves depositing a semiconductor film 16 onto a dielectric surface 14. Katz, col. 2, lines 52-54. Katz' bottom contact geometry semiconductor device is shown in FIG. 2. In such a bottom contact geometry, source and drain contacts 38 and 40 are formed onto a dielectric layer 34, with the semiconductor layer 36 being formed over at least a portion of the contacts 38 and 40 and over a portion of the dielectric layer 34. Katz, col. 2, line 64 through col. 3, line 4. Katz discloses at col. 3, lines 15-17, that: "Suitable dielectric materials include silicon oxide, spin-on glass, and liquid-phase processable polymeric materials such as polyimides and poly(methacrylates)." Katz discloses semiconductor compositions, for example at col. 3, line 66 through col. 4, line 23.

<u>Katz Fails to Disclose or Suggest a Surface Having Exposed Aromatic Groups</u>

Katz fails to disclose and fails to suggest, in any part pointed to by the Official Action, the use of an <u>aromatic</u> material in forming the dielectric layer of Katz's semiconductor devices. Contrary to the assertion by the Official Action that "polyimide is aromatic polymer",

polyimides can be either aromatic or non-aromatic. The chemical term "imide" merely denotes the divalent radical –CONRCO- and does not determine that the polymer is necessarily an aromatic polymer. Katz merely teaches, in the passage at col. 3, lines 15-17 pointed to by the Official Action, that: "Suitable dielectric materials include silicon oxide, spin-on glass, and liquid-phase processable polymeric materials such as polyimides and poly(methacrylates)." There, Katz simply discloses "polyimides" and "poly(methacrylates)". Katz fails to disclose or suggest, in any part pointed to by the Official Action, the selection of an aromatic material as an ingredient of the composition for Katz's dielectric layer. Further, the "poly(methacrylates)" mentioned together with "polyimides" by Katz in the passage at col. 3, lines 15-17 as desirable dielectric materials, are not indicated as being aromatic in any part of Katz to which the Official Action points. Also, the chemical structure of methyl methacrylate for example, which is not aromatic, is H_2C=CHCO-OCH_3. Polymerization of methyl methacrylate yields non-aromatic poly(methyl 2-methylpropenoate), also known as polymethyl methacrylate ("PMMA"). Katz fails to disclose and fails to suggest, in any part pointed to by the Official Action, a semiconductor device including a dielectric layer surface having exposed aromatic groups.

Katz Fails to Disclose or Suggest a Dielectric Layer Formed From Appellants' Claimed Precursors

Katz fails to disclose and fails to suggest, in any part pointed to by the Official Action, a dielectric layer as recited in part by independent claims 1 and 19:

> formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols.

Claims 1 and 19 expressly recite a dielectric layer 130, 230 having a surface including exposed aromatic groups formed from one or more aromatic naphthalene, styrene, phenol, benzene, and cresol precursors. These claim recitations directly link the aromatic structures of the precursors and the structures of the exposed aromatic groups on the surface of the dielectric layer in Appellants' claimed devices. Claims 1 and 19 thus expressly recite a dielectric layer 130, 230 having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols, benzenes, and cresols. This definition of the composition of the surface of the dielectric layer 130, 230 is a structural limitation of claims 1 and 19. Katz fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols, benzenes, and cresols. Therefore, Katz does not anticipate claim 1 or claim 19.

These recitations in Appellants' claims 1 and 19 also imply the specific chemical structures of aromatic polymers forming the dielectric layer when Appellants' claimed aromatic precursors are utilized, selected from naphthalenes, styrenes, phenols, benzenes, and cresols. One of ordinary skill in the art of polymer science knows and readily understands the polymer structures that are obtained when aromatic precursors selected from "naphthalenes, styrenes, phenols, benzenes, and cresols" are polymerized, using conventional techniques for carrying out the polymerizations. The recitations in Appellants' claims 1 and 19 of aromatic precursors selected from "naphthalenes, styrenes, phenols, benzenes, and cresols" would be expected to impart distinctive structural characteristics to the apparatus 100, 200, including the incorporation of the aromatic structures of the precursors in the structures of the dielectric layers. Such

recitations are capable of construction as structural limitations of the claims. See the MPEP, section 2131, citing *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979). Katz fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having the structure implied by forming a dielectric layer from a precursor composition including a member selected from the group consisting of naphthalenes, styrenes, phenols, benzenes, and cresols. Therefore, Katz does not anticipate claim 1 or claim 19.

<u>Katz Fails to Disclose and Fails to Suggest Appellants' Independent Claim 1 or 19</u>

Katz fails to disclose and fails to suggest, in any part pointed to by the Official Action, a semiconductor device including a dielectric layer surface having exposed aromatic groups. Katz fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having a surface including exposed aromatic groups selected from the aromatic groups of naphthalenes, styrenes, phenols, benzenes, and cresols. Katz fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having the structure implied by forming a dielectric layer from a precursor composition including a member selected from the group consisting of naphthalenes, styrenes, phenols, benzenes, and cresols. Therefore, Katz does not anticipate claim 1 or claim 19. Claims 2, 3, 7-8, 10, 11, 13, and 22-24 all depend directly or indirectly from claim 1 and are not anticipated by Katz for the same reasons as discussed above regarding claim 1.

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REJECTION OF CLAIMS 5-6, 12-13, 21, AND 28-30 UNDER 35 U.S.C. §103(A) AS ASSERTEDLY OBVIOUS OVER KATZ IN VIEW OF KLAUK AND MUSHRUSH

Independent claim 28 and its dependent claim 29, and claims 5-6, 12-13 and 21 depending from independent claim 1, and claim 30 depending from independent claim 19, were rejected under 35 U.S.C. § 103(a) as being assertedly obvious over Katz in view of Klauk and Mushrush.

Claims 28 and 29

Independent claim 28 expressly recites the polymer compositions of the dielectric layers in the claimed devices. These polymer compositions are structural elements of independent claim 28. The Official Action has not identified a reason justified by the facts in the record on appeal that would have prompted a person of ordinary skill in the relevant field to combine parts of Klauk with parts of Katz and Mushrush in the way that Appellants' claim 28 does. Moreover, the proposed combination of Katz, Klauk and Mushrush fails to disclose and fails to suggest independent claim 28 or its dependent claim 29.

The Recited Dielectric Layer Compositions Are Structural Limitations of Claim 28

Independent claim 28 recites, in part:

> a dielectric layer…including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate).

Independent claim 28 recites the chemical classes of polymer compositions of the dielectric layer 130, 230 of the devices 100, 200. This recitation of such polymer compositions is a structural element of claim 28. The polymer compositions are not process steps.

Additional Structural Limitations of Claim 28

Independent claim 28 further recites in part:

> a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups.

The recitation of "...a dielectric layer comprising a surface...having exposed aromatic groups..." further defines the chemical composition of the surface of the dielectric layer. That recitation is a structural limitation of claim 28.

Independent claim 28 additionally recites in part:

> a polycrystalline semiconductor layer comprising an organic semiconductor composition overlying and in contact with said portion of said surface, said organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

The recitation of "...a polycrystalline semiconductor layer comprising an organic semiconductor composition... comprising alkyl chains at ends of the chain-like moiety" defines the chemical composition of the semiconductor layer. That recitation, too, is a structural limitation of claim 28.

Katz Fails to Disclose or Suggest Appellants' Devices Recited in Claim 28

Katz fails to disclose and fails to suggest, in any part pointed to by the Official Action, a semiconductor device including a dielectric layer "surface having exposed aromatic groups." In this regard, the Official Action cites Katz's reference to "polyimides" in the passage pointed to at col. 3, lines 15-17. Katz there fails to disclose and fails to suggest the use of an aromatic polyimide in forming the dielectric layer of Katz's semiconductor devices. Katz fails to disclose or suggest, in any part pointed to by the Official Action, the selection of an aromatic polyimide or any other aromatic material as an ingredient of the composition for Katz's dielectric layer. The "poly(methacrylates)", mentioned together with "polyimides" by Katz in the passage at col. 3, lines 15-17 as desirable dielectric materials, are not indicated as being aromatic in any part of Katz to which the Official Action points. Methyl methacrylate, for example, is a commonly-polymerized methacrylate. The chemical structure of methyl methacrylate, which is not aromatic, is $H_2C{=}CHCO{-}OCH_3$. Polymerization of methyl methacrylate yields non-aromatic poly(methyl 2-methylpropenoate), also known as polymethyl methacrylate ("PMMA"). Katz fails to disclose and fails to suggest a semiconductor device including a dielectric layer surface having exposed aromatic groups as recited in Appellants' claim 28.

Katz also fails to disclose and fails to suggest, in any part pointed to by the Official Action, a device as recited in Appellants' claim 28 having a dielectric layer including "a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate)." Katz teaches, in the passage at col. 3, lines 15-17 pointed to by the Official Action, that: "Suitable dielectric materials include silicon oxide, spin-on glass, and liquid-phase processable polymeric materials such as polyimides and poly(methacrylates)." Katz's dielectric materials disclosed in the passage pointed to by the Official Action do not

include a polyphenol, a polystyrene, poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or poly(phenoxyethyl methacrylate). Katz discloses "poly(methacrylates)", but fails to disclose or suggest, in any part pointed to by the Official Action, aromatic poly(methacrylates), or in particular, either of the two aromatic poly(methacrylates) recited in claim 28 - poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), and poly(phenoxyethyl methacrylate). Therefore, Katz fails to disclose and fails to suggest a device having a dielectric layer including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate) as recited in Appellants' claim 28.

The Legal Standard for Combining References

The United States Supreme Court recently updated the legal standard for combining together the teachings of multiple references in making obviousness rejections, in *KSR International Co.* v. *Teleflex Inc. et al.* (Slip Opinion, S.Ct., April 30, 2007). ("*KSR* v. *Teleflex*"). The Court also cited *Graham* v. *John Deere Co. of Kansas City*, 383 U.S. 1 (1966) with approval, and noted that while the sequence of the *Graham* questions might be reordered in any particular case, the *Graham* factors continue to define the inquiry that controls obviousness determinations. (*KSR* v. *Teleflex*, slip op. at 2). The *KSR* v. *Teleflex* opinion instructs that there must be a showing of an apparent reason to combine known elements in the fashion claimed by the patent claims at issue. *KSR* v. *Teleflex* further cautions that a claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. The following excerpts from the *KSR* v. *Teleflex* opinion are instructive:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* and *Anderson's-Black Rock* are illustrative - a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions. Following these principles may be more difficult in other cases...because the claimed subject matter may involve more than the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement. Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the market-place; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit. (*KSR* v. *Teleflex*, slip op. at 13-14).

* * *

As is clear from cases such as *Adams*, a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to

their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. (*KSR* v. *Teleflex*, slip op. at 14-15).

* * *

One of the ways in which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims. ... Under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. ... When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. (*KSR* v. *Teleflex,* slip op. at 16-17).

The proposed combination of Katz, Klauk and Mushrush

Is Unjustified, and Fails to Disclose or Suggest

Appellants' Devices Recited in Claim 28

Klauk. Klauk discloses a pentacene organic thin film transistor including poly-4-vinylphenol-co-2-hydroxyethylmethacrylate as a gate dielectric layer. Klauk, p. 5259, right column. Pentacene, the semiconductor composition that Klauk uses, does not have the alkyl

chains defined in Appellants' claim 28. Klauk fails to disclose and fails to suggest, in any part pointed to by the Official Action, a device as recited in Appellants' claim 28 including an organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and <u>comprising alkyl chains at ends of the chain-like moiety</u>. Therefore, Klauk fails to disclose and fails to suggest Appellants' claim 28.

<u>The Proposed Combination including Katz and Klauk</u>. Appellants' claim 28 recites the use of aromatic dielectric layers including a composition selected from polyphenols, polystyrenes, poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), and poly(phenoxyethyl methacrylate)s. Katz, in the parts pointed to by the Official Action, discloses the use of various dielectric layers, but fails to disclose or suggest the use of an <u>aromatic</u> dielectric layer. Katz teaches that suitable dielectric materials include silicon oxide, spin-on glass, and liquid-phase processable polymeric materials such as polyimides and poly(methacrylates). Katz, col. 3, lines 15-17. Katz discloses examples of devices in the Table at columns 5-10, including their carrier mobilities. The highest mobility disclosed by Katz, .03 cm^2/Vs, was reported for a device having a semiconductor formed on a silicon dioxide dielectric surface. Another example made with a glass resin dielectric gave a highest mobility with a glass resin dielectric of .02 cm^2/Vs. The highest mobility with a polyimide dielectric was .01 cm^2/Vs, and the highest mobility with a PMMA/HEMA polymer was 0.02 cm^2/Vs. In summary, Katz obtained its highest reported mobility, .03 cm^2/Vs, using a silicon dioxide dielectric; and all of Katz' "highest" mobilities had a uniform order of magnitude.

Klauk teaches the use of a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate ("PVP copolymer") dielectric layer with pentacene, an organic semiconductor that does not have the

alkyl chains recited in Appellants' claim 28. Klauk teaches that "[t]he electrical performance of organic thin film transistors is often measured in terms of the carrier field-effect mobility." Therefore, mobility is a suitable property for comparing the electrical performance of such transistors. Klauk also points out that the largest carrier mobilities for organic thin film transistors have been reported in the literature for devices employing pentacene as the active semiconductor, and notes that mobilities of 3 cm^2/Vs have been reported for pentacene films. Klauk, p. 5259. The performance properties of Klauk's own devices are summarized in TABLE 1 on p. 5262. For devices having dielectrics of PVP copolymer and of silicon dioxide with an octadecyltrichlorosilane layer, the carrier mobilities in cm^2/Vs were, respectively: 2.9 and 1.0. TABLE 1 also indicates that the on/off current ratio for the silicon dioxide dielectric device was 100 times larger, hence better, than for the PVP copolymer device.

The Official Action has not justified the proposed combination of Katz and Klauk under the *KSR* v. *Teleflex* standard. Klauk teaches that the electrical performance of organic thin film transistors is often measured in terms of the carrier field-effect mobility. See, likewise, Appellants' specification at page 21, lines 1-3. Hence, mobility, rather than other electrical properties, is often used in comparing the electrical performance of such devices. One of ordinary skill in the art, seeking to maximize the carrier field-effect mobility of Katz' devices, would not have any reason for using Klauk's poly(4-vinylphenol-co-2-hydroxyethyl methacrylate) dielectric layer in Katz's device that is justified by the parts of Katz and Klauk pointed to by the Official Action. Klauk's highest mobility, using poly-4-vinylphenol-co-2-hydroxyethylmethacrylate, was 3 cm^2/Vs – no better than the results Klauk reports from the literature for prior pentacene devices at p. 5259. Klauk teaches that carrier mobilities using pentacene on either a silicon dioxide dielectric layer or on a poly-4-vinylphenol-co-2-

hydroxyethylmethacrylate (PVP copolymer) dielectric layer are both of a uniform order of magnitude – respectively 1 and 3 cm^2/Vs. Katz, like Klauk, teaches mobility results for devices using silicon dioxide and polymer dielectrics that have a uniform order of magnitude – respectively .03 and .02 cm^2/Vs. Klauk's mobilities, in devices made using pentacene, are two orders of magnitude – 100 times - greater than Katz's mobilities in devices using other semiconductors. Each of Katz and Klauk teach mobilities having a uniform order of magnitude for both polymer dielectrics and silicon dioxide dielectrics, Klauk's mobilities being about 100 times higher than Katz's mobilities. The teachings of Katz and Klauk raise an expectation that the mobility of a Katz device having a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric layer would have an order of magnitude of .01 cm^2/Vs as do Katz's other "highest" mobilities. Appellants, however, have disclosed "extremely high mobilities in excess of 0.1" cm^2/Vs, and of .24, .65, .15 and .37 cm^2/Vs – an order of magnitude – 10 times - greater than Katz's highest mobilities - for devices using Appellants' recited semiconductors on a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric layer. See Appellants' specification, page 16, line 19 through page 17, line 3; Table 1 at page 20; and page 24, lines 21-25. The Official Action has not pointed to any teaching of Katz or Klauk that would lead one of ordinary skill in the art to believe that using Klauk's poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric in Katz's devices would result in a ten-fold increase in device mobility compared with Katz's own teachings, nowhere taught or suggested by Katz or Klauk, to "in excess of 0.1" as Appellants have disclosed.

Mushrush. Mushrush discloses organic field-effect transistors including semiconductors on silicon dioxide and glass resin substrates. The semiconductors disclosed include: 2,5-bis(4-n-hexylphenyl)thiophene; 5,5'-Bis(4-n-hexylphenyl)-2,2'-bithiophene (6PTTP6);

5,5"-Bis(4-n-hexylpheny- l)-2,2':5',2"-terthiophene (6PTTTP6); 5,5'''-Bis(4-n-hexylphenyl)-2,2':5',2":5",2'''-quaterthiophene (6PTTTTP6); 1,4-Bis[5-(4-n-hexylphenyl)-2-thienyl]benzene (6PTPTP6); 2,5-Bis[4(4'-n-hexylphenyl)phenyl- l]thiophene (6PPTPP6). Mushrush, p. 9414. The Official Action has not pointed to any part of Mushrush that teaches or suggests Appellants' dielectric polymers recited in claim 28.

Combination of Katz, Klauk, and Mushrush. Each of Katz and Mushrush fails to disclose and fails to suggest a dielectric layer as recited in Appellants' claim 28 having a surface with exposed aromatic groups. Each of Katz and Mushrush fails to disclose and fails to suggest a dielectric layer as recited in Appellants' claim 28 including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate). Klauk teaches the use of a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric layer with pentacene, an organic semiconductor that does not have the alkyl chains recited in Appellants' claim 28. The Official Action has not pointed to any teaching of Katz or Klauk that would lead one of ordinary skill in the art to believe that using Klauk's poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric in Katz would result in a ten-fold increase in device mobility nowhere taught or suggested in Katz and Klauk, to "in excess of 0.1".. There is no apparent reason identified by the Official Action why one of ordinary skill in the art would be motivated to combine the parts of Katz and Klauk as proposed, to generate a combination of elements in the fashion defined in Appellants' claim 28. The Official Action has not pointed to any facts stated in Klauk that would lead one of ordinary skill in the art to believe that a device having improved mobility could be made by substituting Klauk's PVP copolymer in Katz's devices. As to on/off current ratio, Klauk's results reported in Table 1 were higher – thus better - for silicon dioxide dielectrics, which are also one of Katz's disclosed dielectrics, than for the

PVP copolymer dielectrics. Klauk thus teaches to not use PVP copolymer in Katz's devices insofar as on/off ratio performance is concerned. The Official Action has not pointed to any teachings in Klauk that other device properties show better results for the PVP copolymer than for silicon dioxide, one of Katz's dielectrics; nor has the Official Action pointed to any statements in Klauk or Katz indicating that one of ordinary skill would look to those device properties rather than mobility in deciding whether to combine Klauk's teachings with Katz. For example, Klauk's conclusion on p. 5262 generally characterizes the performance results, reported in Table 1, for both silicon dioxide and PVP copolymer dielectrics as being successful as to both threshold voltage and subthreshold swing. The Official Action has not explained how Klauk's data on these properties would motivate one of ordinary skill in the art to use a PVP copolymer dielectric layer rather than a silicon dioxide dielectric layer – as Klauk's reported performance results for both dielectric layers are comparable. The Official Action refers to "a layer with a refractive index of at least about 1.52". The Official Action has not pointed to any portions of Katz or Klauk that disclose or discuss refractive indices of dielectric layers; nor does claim 28 recite a refractive index. Appellants further note that claim 28 does not recite semiconductor crystal size or mobility. Claim 29 depends from claim 28 and is unobvious for the same reasons as discussed above regarding claim 28.

Claims 21 and 30

Claims 21 and 30 respectively depend from independent claims 1 and 19. Each of claims 21 and 30 recite the same semiconductor compositions as does claim 28. Each of claims 21 and 30 further recite, in part:

> a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups, said dielectric layer including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate).

Since claims 21 and 30 both include all of the limitations of claim 28, they are unobvious over the proposed combination of Katz, Klauk and Mushrush for the same reasons discussed above as to claim 28.

Claims 21 and 30 both additionally recite, in part:

> dielectric layer being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols.

Claims 21 and 30 thus expressly recite a dielectric layer 130, 230 having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols, benzenes, and cresols. Each of Katz and Mushrush fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols, benzenes, and cresols. Each of Katz and Mushrush also fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having the structure implied by forming a dielectric layer from a precursor composition including a member selected from the group consisting of naphthalenes, styrenes, phenols, benzenes, and cresols. Klauk teaches the use of a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric layer with pentacene, an organic

semiconductor that does not have the alkyl chains recited in Appellants' claims 21 and 30. The Official Action has not pointed to any teaching of Katz or Klauk that would lead one of ordinary skill in the art to believe that using Klauk's poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric in Katz would result in a ten-fold increase in device mobility nowhere taught or suggested in Katz and Klauk, to "in excess of 0.1". There is no apparent reason identified by the Official Action why one of ordinary skill in the art would be motivated to combine the parts of Katz and Klauk as proposed, to generate a combination of elements in the fashion defined in Appellants' claims 21 and 30. The Official Action has not pointed to any facts stated in Klauk that would lead one of ordinary skill in the art to believe that a device having improved mobility could be made by substituting Klauk's PVP copolymer in Katz's devices. As to on/off current ratio, Klauk's results reported in Table 1 were higher – thus better - for silicon dioxide than for the PVP copolymer. The Official Action has not pointed to any teachings in Klauk that other device properties show better results for the PVP copolymer than for silicon dioxide; nor that one of ordinary skill would look to those device properties rather than mobility in deciding whether to combine Klauk's teachings with Katz. For example, Klauk's conclusion on p. 5262 generally characterizes the performance results, reported in Table 1, for both silicon dioxide and PVP copolymer dielectrics as being successful as to both threshold voltage and subthreshold swing. The Official Action has not explained how Klauk's data on these properties would motivate one of ordinary skill in the art to use a PVP copolymer dielectric layer rather than a silicon dioxide dielectric layer – as Klauk's reported performance results for both are comparable.

Claim 12

Claim 12 depends from independent claim 1, and further recites:

> ...dielectric layer comprises poly(4-vinylphenol-co-2-hydroxyethyl methacrylate).

Accordingly, claim 12 recites "...a dielectric layer comprising a surface...having exposed aromatic groups...", and the same semiconductor compositions as does claim 28, and one of the dielectric layer compositions recited in claim 28 - poly(4-vinylphenol-co-2-hydroxyethyl methacrylate). Claim 12 therefore is unobvious over the combination of Katz, Klauk and Mushrush for the same reasons discussed above as to claim 28.

Claims 5, 6, and 13

Claims 5, 6 and 13 depend from independent claim 1. Each of claims 5, 6 and 13 accordingly recites, in part, "...a dielectric layer comprising a surface...having exposed aromatic groups...", and the same semiconductor compositions as does claim 28.

Each of claims 5, 6 and 13 additionally recites, in part:

> dielectric layer being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols.

Claims 5, 6 and 13 thus expressly recite a dielectric layer 130, 230 having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols,

benzenes, and cresols. Each of Katz and Mushrush fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having a surface including exposed aromatic groups selected from the aromatic groups in naphthalenes, styrenes, phenols, benzenes, and cresols. Each of Katz and Mushrush also fails to disclose or suggest, in any part pointed to by the Official Action, a dielectric layer having the structure implied by forming a dielectric layer from a precursor composition including a member selected from the group consisting of naphthalenes, styrenes, phenols, benzenes, and cresols. Each of Katz and Mushrush fails to disclose and fails to suggest, in any part pointed to by the Official Action, a semiconductor device including a dielectric layer "surface having exposed aromatic groups." Klauk teaches the use of a poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric layer with pentacene, an organic semiconductor that does not have the alkyl chains recited in Appellants' claims 5, 6 and 13. The Official Action has not pointed to any teaching of Katz or Klauk that would lead one of ordinary skill in the art to believe that using Klauk's poly-4-vinylphenol-co-2-hydroxyethylmethacrylate dielectric in Katz would result in a ten-fold increase in device mobility nowhere taught or suggested in Katz and Klauk, to "in excess of 0.1". There is no apparent reason identified by the Official Action why one of ordinary skill in the art would be motivated to combine the parts of Katz and Klauk as proposed, to generate a combination of elements in the fashion defined in Appellants' claims 5, 6 and 13. The Official Action has not pointed to any facts stated in Klauk that would lead one of ordinary skill in the art to believe that a device having improved mobility could be made by substituting Klauk's PVP copolymer in Katz's devices. The Official Action has not pointed to any teachings in Klauk that other device properties show better results for the PVP copolymer than for silicon dioxide; nor that one of

ordinary skill would look to those device properties rather than mobility in deciding whether to combine Klauk's teachings with Katz.

REJECTION OF CLAIM 26 UNDER 35 U.S.C. §103(A) AS ASSERTEDLY OBVIOUS OVER KATZ IN VIEW OF KATZ ARTICLE

Claim 26, which depends from claim 1, was rejected under 35 U.S.C. §103(a) as assertedly obvious over Katz in view of the Katz Article. The Katz Article discloses thin film transistors formed by thermally growing silicon dioxide dielectric on n-doped silicon substrate gates. For the bottom contact geometry, gold electrodes were photolithographically defined, and the semiconductor was deposited over the entire electrode/dielectric surface. For the top contact geometry, gold electrodes were defined after semiconductor deposition. Katz Article, p. 634, right column. Katz and the Katz Article, taken alone or together, fail to disclose and fail to suggest a semiconductor device including: a dielectric layer surface having exposed aromatic groups; or having aromatic groups selected from naphthalenes, styrenes, phenols, benzenes, and cresols; or having the structure implied by forming a dielectric layer from a precursor composition including a member selected from the group consisting of naphthalenes, styrenes, phenols, benzenes, and cresols. Therefore, the combination of the Katz and the Katz Article does not make obvious claim 26.

Conclusion

Katz, Klauk and Mushrush fail to disclose and fail to suggest a device having all of the structural elements recited in any of Appellants' claims. Appellants therefore request a reversal of the final rejections of these claims and allowance of this patent application.

Respectfully submitted,

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Claims - Appendix

1. (Previously presented) A semiconductor apparatus, comprising: a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups, said dielectric layer being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols; and a polycrystalline semiconductor layer comprising an organic semiconductor composition overlying and in contact with said portion of said surface, said organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

2. (Original) The semiconductor apparatus of claim 1, in which each of said moieties comprises on average at least about three conjugated aromatic rings.

3. (Original) The semiconductor apparatus of claim 1, in which the alkyl chains comprise on average between about 3 and about 12 carbon atoms.

4. (Cancelled).

5. (Original) The semiconductor apparatus of claim 1, in which said polycrystalline semiconductor layer has a mobility of at least about 0.1 centimeters squared per volt-second.

6. (Original) The semiconductor apparatus of claim 1, in which said polycrystalline semiconductor layer has an average semiconductor crystal size of at least about 0.1 micrometer.

7. (Original) The semiconductor apparatus of claim 1, further comprising: a gate electrode; a source electrode; and a drain electrode; said source and drain electrodes being in spaced apart conductive contact with a channel portion of said semiconductor layer, said gate electrode being positioned to control a conductivity of said channel portion.

8. (Original) The semiconductor apparatus of claim 2, in which each of said moieties comprises on average between about three and about six conjugated aromatic rings.

9. (Cancelled).

10. (Original) The semiconductor apparatus of claim 7, in which the channel portion has an on/off ratio of at least about 100.

11. (Original) The semiconductor apparatus of claim 8, in which the semiconductor composition comprises a member selected from the group consisting of: 5,5'-Bis(4-*n*-hexylphenyl)-2,2'-bithiophene; 5,5"-Bis(4-*n*-hexylphenyl)-2,2':5',2"-terthiophene; 5,5'"-Bis(4-*n*-hexylphenyl)-2,2':5',2":5",2'"-quaterthiophene; 1,4-Bis[5-(4-*n*-hexylphenyl)-2-thienyl]benzene; 2,5-Bis[4(4'-*n*-hexylphenyl)phenyl]thiophene; 5,5'"-Bis(4-*n*-hexyl)-2,2':5',2":5",2'"-quaterthiophene; 5,5""-Bis(4-*n*-hexyl)-2,2':5',2":5",2'":5'",2""pentathiophene; 1,4-Bis[(5-*n*-hexyl)-2,2'-bithienyl]benzene; 2,6-bis(5-hexylthien-2-yl)naphthalene; and mixtures.

12. (Previously presented) The semiconductor apparatus of claim 1, in which said dielectric layer comprises poly(4-vinylphenol-co-2-hydroxyethyl methacrylate).

13. (Original) The semiconductor apparatus of claim 11, in which the semiconductor composition comprises 5,5'-Bis(4-n-hexylphenyl)-2,2'-bithiophene.

14-18. (Cancelled)

19. (Previously presented) An integrated circuit, comprising: a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups, said dielectric layer being formed from a precursor composition including a member selected from the group consisting of: naphthalenes, styrenes, phenols, benzenes, and cresols; a polycrystalline semiconductor layer comprising an organic semiconductor composition overlying and in contact with said portion of said surface, said organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety; a gate electrode; a source electrode; and a drain electrode; said source and drain electrodes being in spaced apart conductive contact with a channel portion of said semiconductor layer, said gate electrode being positioned to control a conductivity of said channel portion.

20. (Cancelled)

21. (Previously presented) The semiconductor apparatus of claim 1, in which said dielectric layer comprises a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate).

22. (Previously presented) The semiconductor apparatus of claim 1, in which an alkyl chain comprises, as a linkage in the chain, a member selected from the group consisting of oxygen, nitrogen or sulfur.

23. (Previously presented) The semiconductor apparatus of claim 1, in which an alkyl chain comprises a hetero substituent.

24. (Previously presented) The semiconductor apparatus of claim 1, in which a thiophene or phenyl group includes an alkyl- or hetero-substituent.

25. (Cancelled).

26. (Previously presented) The semiconductor apparatus of claim 1, in which the dielectric layer has at least the polarizability of chlorobenzene.

27. (Cancelled).

28. (Previously presented) A semiconductor apparatus, comprising: a dielectric layer comprising a surface, a portion of said surface having exposed aromatic groups, said dielectric

layer including a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate); and a polycrystalline semiconductor layer comprising an organic semiconductor composition overlying and in contact with said portion of said surface, said organic semiconductor composition comprising a compound comprising a chain-like moiety, the chain-like moiety comprising a conjugated thiophene or phenyl group and comprising alkyl chains at ends of the chain-like moiety.

29. (Previously presented) The semiconductor apparatus of claim 28, further comprising: a gate electrode; a source electrode; and a drain electrode; said source and drain electrodes being in spaced apart conductive contact with a channel portion of said semiconductor layer, said gate electrode being positioned to control a conductivity of said channel portion.

30. (Previously presented) The integrated circuit of claim 19, in which said dielectric layer includes a polyphenol, a polystyrene, a poly(4-vinylphenol-co-2-hydroxyethyl methacrylate), or a poly(phenoxyethyl methacrylate).

Evidence - Appendix

(None)

Related Proceedings - Appendix

(None)